Queensland University of Technology

DISCUSSION PAPERS IN ECONOMICS, FINANCE AND INTERNATIONAL COMPETITIVENESS

A Test of Weak-Form Market Efficiency in Australian Bank Bill Futures Calendar Spreads

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Discussion Paper No. 134, January 2003

Series edited by
Associate Professor Andrew Worthington

School of Economics and Finance

ISSN 1324-5910

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A Test of Weak-Form Market Efficiency in Australian Bank Bill Futures Calendar Spreads

John A Anderson

Abstract:

This paper demonstrates how the presence of a lower interest rate expectations detected in short-term interest rate futures during the 1990's allowed arbitrage profits when trading intra-commodity spread differentials on the Sydney Futures Exchange's 90 Day Bank Accepted Bill futures contract. Fama's (1970) hypothesis on market efficiency cannot be accepted for the test period as statistically significant gross profits were generated by a naïve strategy. The EMH had greater predictive power once transactions costs were deducted. Furthermore, the EMH remained unable to be accepted after the allowance of generous transaction costs.*

Note: Computer animations of the 90 Day Bank Accepted Bill Futures Yield Curve Differential Animations may be downloaded from http://www.qut.edu.au/its/hpc/gallery/yield_curve/

INTRODUCTION

Market efficiency issues in futures markets have been widely discussed in the finance literature, see *inter alia* Brorsen and Lukac (1990), Leuthold (1972), Lukac et al. (1988), Lukac and Brorsen (1989), Peterson and Leuthold (1982), Taylor (1992), Taylor (1993), Thomas (1986) and Brock et al. (1992), but little research has been published into the pricing relationships that exist between contracts of different expiries for the same futures contract. These pricing relationships are referred to as 'Calendar Spreads' and of the limited work in this area, most have explored seasonal relationships in agricultural products such as the work of Stevenson and Bear (1970).

This paper identifies yield curve characteristics that existed between the Sydney Futures Exchange's 90 Day Bank Accepted Bill futures of different maturities as they moved closer to expiry during the 1990's. During this period, interest rates were generally falling across the yield curve and the expectations of dealers reflected this by producing a persistent hump in the yield curve. The persistence of the hump produced the possibility for significant profits from dealers exploiting this feature of the yield curve via spread trading in the Sydney Futures Exchange's (SFE) 90 Day Bank Accepted Bill (BAB) futures contract.

While various theories have emerged to explain the basic characteristic shape of a normal yield curve, this paper examines a trading strategy for the shape of the yield curve particularly in the falling rate environment of the 1990's. The most commonly observed shape observed during the test period had a decidedly distinct inverted hump occurring in the

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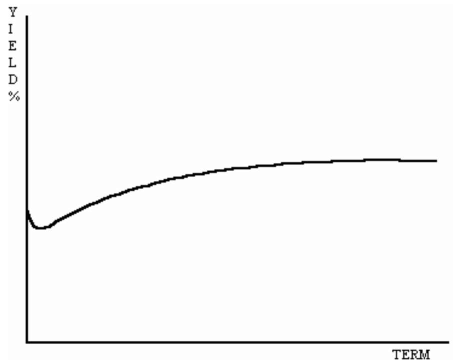
Special thanks to Mark Barry at QUT's High Performance Computing Support for assistance in producing the animations used in this paper.

zero to six month maturity band before taking on the characteristic time-premium often observed in yield curves. This is depicted in Figure 1 below.

Figure 1: Generalised Implied Australian Yield Curve Shape – 1990's



It must be noted that this paper explicitly avoids discussion on why the yield curve adopted the observed shape, ie the persistence of the hump at the zero to six month part of the curve. It seeks to demonstrate that such a yield curve shape provided significantly persistent trading profits for futures traders.

Apart from the study presented here, an additional valuable resource offered by this paper is provided in the form of a downloadable animated yield curve. The shape of the yield curve, implied from the 90 Day Bank Accepted Bill futures contract, has been animated using Matlab[1] using daily settlement prices. The use of data visualisation techniques in this way provides researchers with an important additional tool for observing a variety of characteristics about interest rate changes. The animations are freely available for download from http://www.its.qut.edu.au/hpc/gallery/yield_curve/ .

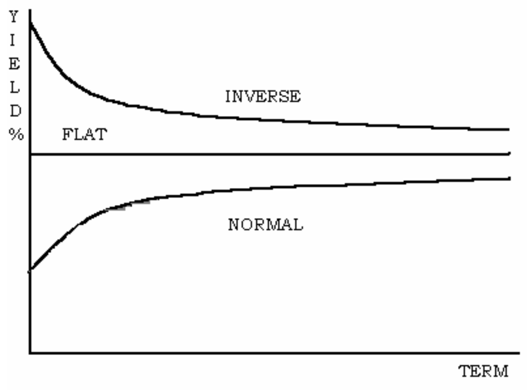
In exploring how spread trading facilitated such profits, the paper is organised into sections outlining the relevant literature, the methodology adopted for testing the negative spread relationships, the results from the testing and finally a conclusion. The quarter-by-quarter profit performances for all spread relationships examined appear in Appendix A for Gross Profits and Appendix B for Net Profits.

LITERATURE SURVEY

A significant body of work has been produced in relation to the shape and possible movements in the yield curve. The three basic yield curve shapes commonly observed are shown in Figure 1 below.

[1] Animations produced by Mark Barry at QUT's High Performance Computing centre using Matlab v5.2. The data points (the red squares) for each frame have been interpolated using a 'cubic' algorithm to produce the smooth curve between the data points. The animation is smoothed between key frames (ie. the original data values for each date) using linear interpolation. Of most interest to researchers should be the spread animation link titled as IRF1.MPG.

Figure 1: Generalised Yield Curve Shapes



Four main theories have been proposed to describe why interest rates differ across the yield curve. These are the expectations hypothesis, liquidity-premium theory, segmentation theory and preferred-habitat theory. A significant number of works have been produced in these areas over a considerable period of time by authors including Brealey and Scheafer (1977), Cargill (1975) and Van Horne (1965) through to Tzavalis and Wickens (1997) and Lange (1999).

When considering the term premium in interest rates, Campbell and Shiller (1991) note that unless a term premium is apparent investors should be indifferent to the returns from holding a long-term bond or rolling-over a sequence of shorter-term bonds. A general form of the term structure model incorporating a term premium is provided below from Dotsey and Otrok (1995). The interest rate on a long-term bond of maturity n is $r_t(n)$ and will obey,

(1) $$r_t(n) = \frac{1}{k}\sum_{i=0}^{k-1} E_t r_{t+mi}(m) + f_t(n,m)$$

where $r_{t+mi}(m)$ is the m period bond rate at $t+mi$, E_t is the conditional expectations operator over time t information and $f_t(n,m)$ is the term premia between the n and m period bonds.

Of course, the discussion of a term-premium does not necessarily take the ‘humped’ feature of yield curves into account where the term-premia between different maturities does not lead to a consistently positive expectation E. The occurrences of humped yield curves have been linked to economic phenomena such as changes to the money supply (Brocato and Smith, 1991), discussion of whether a hump appears in intermediate bond yields prior to recession (Hooker, 1999) and the appearance of a humped yield curve in the UK yield curve implied by futures and swap instruments after changes to the UK repo rate (Bank of England Quarterly Report, Aug 1999). As noted earlier, any proof of why the hump exists is beyond the scope of this paper. The aim is to address the market efficiency aspects raised by the persistence of a hump in the yield curve implied by short-term interest rate futures contracts.

As this paper focuses on market efficiency issues, all tests must be considered within the framework of weak-form of the efficient markets hypothesis (EMH) proposed by Fama (1970). Under the weak-form of the EMH, Fama (1970) proposed that a trading model relying on historical data, such that "... the information subset of interest is just past price (or return) histories" (p388), should not be able to generate excess returns.

Fama's (1970) hypothesis contended that financial markets operated in a fair-game model and that trading models relying only on historical information should have a zero-expected return. Therefore, the hypothesis argues the following representation of the use of historical data in trading models,

(2) $$E\,(p_{\,t+1} \mid \Phi_{\,t}) = 0$$

where $\boldsymbol{E}(\pi_{t+1})$ is the expected profit available in the next period relying on the information set Φ available at time t equals zero.

A growing body of contradictory evidence to Fama's (1970) restrictive definition of market efficiency has emerged in subsequent research with Taylor (1993) remarking that the considerable subsequent evidence against the weak-form of the EMH rendered it "suspect". Other authors reporting contradictory evidence include Anderson (1997), Babcock (1989), Bilson and Hsieh (1987), Boothe and Longworth (1986), Leuthold (1972), Lukac et al. (1988), Lukac and Brorsen (1989), Peterson and Leuthold (1982), Stevenson and Bear (1970), Sweeney (1986), Taylor (1992), Thomas (1986) and Brock et al. (1992).

As contradictory evidence about the EMH continues to emerge, it provides a valid justification for further examination of the possibility that anomalies exist within Australian interest rate futures markets. Although many market efficiency papers have concentrated on trading single contracts within various markets, this paper considers the use of a simple trading rule on the pricing relationships within one futures instrument, but of differing expiry dates.

Limited market efficiency evidence has been produced concerning spread relationships between futures contracts. One such test was conducted on spreads between grain contracts by Barrett and Kolb (1995). They examined the inter-commodity pricing relationships between Corn/Oats, Soybean/Wheat, the Soybean 'Crush' (different contracts within the soybean products such as soybean mash, soybeans, soybean oil) and Wheat/Corn. Calendar spread relationships were examined for July/December Corn and July/November Soybeans. Barrett and Kolb (1995) concluded that perceived regularities within spread relationships failed to be present and their finding were consistent with the EMH.

Some work on spreads has focussed on any arbitrage relationships that may exist between different instruments. Murphy (1991) examined Intermarket spread relationships and techniques for their exploration, but neglected to produce any evidence of the profitability (or otherwise) of such trading techniques. Poitras (1987) examined the spread relationship between the implied carry return on gold futures and the Eurodollar rate, the so called 'Golden Turtle'. He found that the cost-of-carry relationship between gold and Eurodollar futures was weakly bound and that arbitrage profits were available between April 1982 and March 1985.

Further work by Rechner and Poitras (1993) examined the 'Soybean Crush' relationships between soybeans, soybean meal and soybean oil. This differed from Poitras' earlier work that examined cost-of-carry relationships in that this study used a simple intra-day technical trading rule (filter rule) to profit from distortions in the Gross Processing Margin relationships that should exist within the same commodity group. Rechner and Poitras (1993) found that the use of naïve filter rules in the soybean crush was able to produce profits, contrary to the zero-expected return predicted under the EMH.

The method for testing the statistical validity of the EMH in the BAB spreads is based on Peterson and Leuthold (1982). They argue that the benchmark for testing returns from trading rules in futures market should be an expected return of zero. They further argue that the use of any other benchmark for studies of futures markets, such as a buy-and-hold strategy often observed in test of equity markets, becomes as meaningless as a sell-and-hold strategy.

This argument is further strengthened when considering that futures do not have the intrinsic return from growth (or positive price drift) observed in equities. Futures trading is considered a zero-sum-game (notwithstanding the welfare enhancing effects of risk transference) where wealth is not created, but simply redistributed between the market's participants. Therefore if we have an expected return of zero, the inclusion of transaction costs should produce a negative expected return from futures trading. This makes the use of the zero-expected return remarkably conservative.

To enhance the conservatism and reliability of the results, transaction costs have been modelled into the profit results. These have been set at $100 round-turn per futures contract traded in accordance with Lukac et al. (1988) and Anderson (1997). This amount is comparable with transaction costs used in other studies including Babcock (1989), Bilson and Hsieh (1987), Boothe and Longworth (1986), Lukac and Brorsen (1989), Sweeney (1986) and Taylor (1993). As the trading of a calendar spread requires the trading of two futures contracts simultaneously, transaction costs of $200 have been deducted for each spread traded during each quarter.

METHODOLOGY

The methodology for the 'negative spread' trade used here relies on profits being generated by the narrowing of interest rate differentials as the futures contracts move closer to expiry where the hump is observed. This requires the selling of the spot, or near, BAB futures contract at a price P_S and repurchasing the futures position at the price one day before expiry, *e*, P_{St+e}. At the same time this short futures position is taken, a long position is simultaneously opened in the deferred, or next, expiring contract P_D and it is sold at P_{Dt+e}, the same time the short position is repurchased at P_{St+e}.

As an example, the opening of this trading position in September 2000 would require the short sale of the December 2000 BAB futures contract and the simultaneous purchase of a March 2001 BAB contract. The spread position is closed out on the day prior to the expiry of the spot contract, therefore in this example the position is closed out one day prior to the expiry of the December BAB futures contract. A strategy where the near contract is sold short and a long position is simultaneously opened in a more distant contract is generally referred to as a *negative spread*.

The naïve strategy adopted in this paper opens a negative spread for a given expiry date of a contract and the position's profitability is reported for various holding periods. The example in the previous paragraph outlines the reporting method where the spread position is held for three months. Testing in this paper examines the performance where the holding period is between three and eighteen months in three month intervals.

The price of the 90 Day Bank Accepted Bill P_{BAB} contract trade on the SFE is calculated according to the following formula,

(3)
$$P_{BAB} = \frac{\$1{,}000{,}000}{1 + r\left(\frac{90}{365}\right)}$$

where r is the interest rate from the BAB futures price calculated as,

(4)
$$r = \frac{(100 \text{ - Futures Price})}{100}$$

As Australian pricing conventions have interest rate futures reported as 100 minus the yield, the BAB contract must be priced for each trade to provide an accurate dollar value for reported profits. To calculate the profit, π, from the BAB spread position, the following method has been used relying on the price of the futures contracts at their respective futures prices.

(5)
$$p_{t+1} = \left[\left(P_{St} - P_{St+e}\right) + \left(P_{Dt+e} - P_D\right)\right] - t$$

Therefore the profit (loss) π_{t+e} realised when the positions are closed out at $t+e$ is the sale of the spot contract P_{St} at time t minus the purchase price of the spot contract one day before its expiry being P_{St+e}. This must have the profit (loss) added from the sale of the deferred contract P_{Dt+e} minus the price at which it is purchased at P_D. The final value subtracted from the gross profits is an amount of $200 for transaction costs t.

The statistical significance of reported profits will be in the form of a *t*test[2] for all results. To concur with the zero-expected excess return predicted under the EMH, μ has been set at zero. Consequently, the following hypothesis test to determine the excess return (or otherwise) is proposed,

H_0: $\bar{x}_{pt+e} = 0$

H_A: $\bar{x}_{pt+e} > 0$

Therefore if the EMH produces average profits equal to zero during the test period, then H_0 will not be rejected. Conversely, if average profits for each holding period examined are not the zero-expected return predicted under the EMH, H_0 must be rejected.

RESULTS

This section presents the results of the naïve negative spread strategy when applied to the SFE's BAB futures contract. The data has been sourced from the SFE's website at http://www.sfe.com.au and covers the futures contracts listed between June 1990 and December 1998. End of day data only has been used and no intra-day position taking has been permitted with all trades being conducted at the SFE's reported settlement prices for the relevant BAB contracts.

[2] The one-tailed *t*-statistic for the annual profitability was calculated as,

$$t = \frac{\bar{x} - m}{s / \sqrt{n}}$$

BAB futures are traded in three-month expiry cycles. The contracts traded are for expiry in the months of March, June, Sept and Dec (H, M, U and Z respectively) and are based on a bank accepted bill with a face value of $1,000,000[3]. The results are reported for negative spread positions with a holding period of three months to eighteen months in three month increments.

The differentials between contracts one period apart, eg the June 1999 and Sept 1999, and how they track through time are depicted in Figure 2 below. As BAB futures contracts are quoted as 100 minus yield and shows the movement through time, the graph below shows the mean spread size for the contracts examined as each contract moved towards expiry.

Figure 2: Average of Contract Differentials – 1990 to 1998

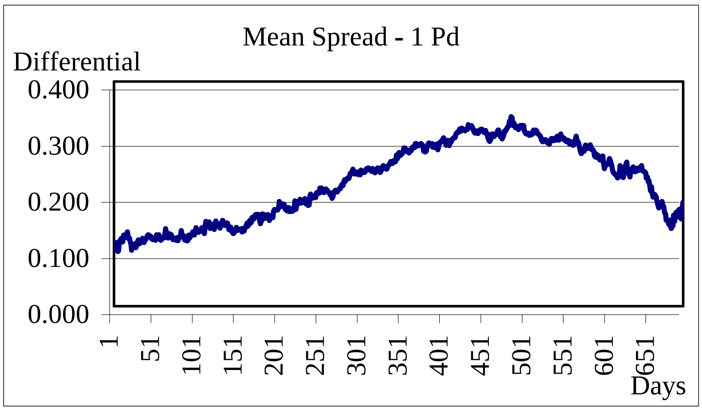


Figure 2 shows that the small hump observed in the short maturity end of the curve translated into the futures contracts quoted as 100 minus the yield. The persistent decline in differentials in the last 150 trading days (approximately 8 calendar months) provided a recurrent and exploitable trading opportunity for interest rate futures spread traders.

The empirical results for the trades are shown in Table 1 below. It outlines the main trading statistics relevant to assessing the performance of the naïve trading rule adopted during the test period. The complete period-by-period results are provided in Appendix A for Gross Profits and Appendix B for Net Profits at the end of this paper.

Table 1: Profit Summary for Different Holding Periods

Holding Period	3 months	6 months	9 months	12 months	15 months	18 months
Total	**$7,982.22**	**$14,639.47**	**$6,441.28**	**$7,591.01**	**$3,874.21**	**-$705.32**
Mean	**$234.77**	**$443.62**	**$201.29**	**$244.87**	**$129.14**	**-$24.32**
Number Trades	**34**	**33**	**32**	**31**	**30**	**29**
Net Profit	**$1,182.22**	**$8,039.47**	**$41.28**	**$1,391.01**	**-$2,125.79**	**-$6,505.32**

Table 1 reveals the trading performance for the negative spread traded during the test period. For trades held for only three months, or for one contract period, the gross profit generated by the negative spread strategy was $7,982.22, with $234.77 as the mean quarterly profit across the 34 trading quarters examined. Transaction costs of $100 per contract (therefore $200 per

[3] Although changes to the contract specifications have occurred, to allow greater comparability of results, all profits have been calculated using the most recently available contract specifications supplied by the SFE.

spread undertaken) were deducted from the reported profit results. With 34 trades undertaken during the test period, the net profit is $7,982.22– ($200 x 34 trades) = $1,182.22.

Figure 3: Gross and Net Profits Across Holding Periods

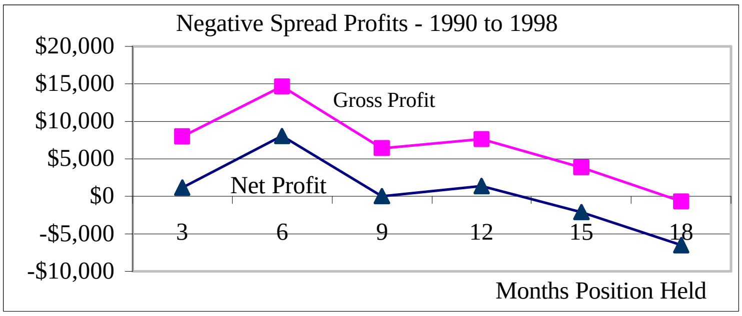


Figure 3 shows the gross and net profit performance across holding periods between three and eighteen months. The six month holding period produced clearly superior returns, while lengthening the holding period leads to sub optimal performance. Profits do increase at the twelve month holding period, but this is still consistent with the decline in profits as the holding period increases beyond six months.

The most profitable holding period reported in these results is for the six month period, with net profits of $8,039.47 produced. Mean net profits per quarter for the six month holding period were $243.62 during the test.

Figure 4: Profitability by Quarter for the Six Month Holding Period

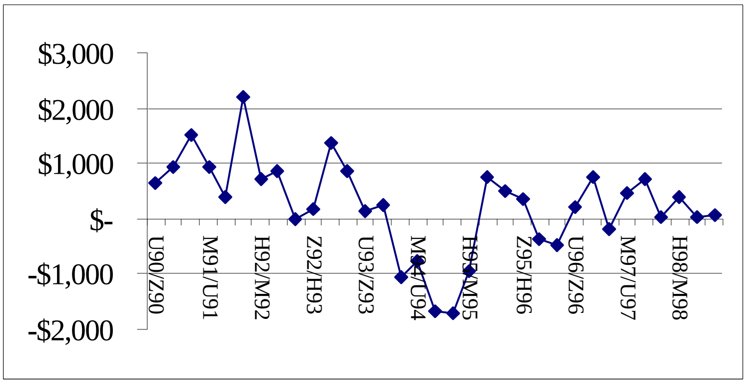


Figure 4 shows the profitability for each negative spread taken during the test period. The negative spread strategy produced net profits in 25 of the 33 quarters (76%) tested. Five of the eight losing quarters were observed around 1994 to 1995 where the differentials between contract months remained generally flat to increasing.

As this paper is essentially a test of the EMH, we must now consider the results in the context of the hypothesis test proposed earlier. Recall that the hypothesis was posed in the following form.

H_0: $\bar{x}_{pt+e} = 0$

H_A: $\bar{x}_{pt+e} > 0$

The null hypothesis stated that the mean profit generated by the trading should equal zero, in accordance with the EMH. Table 1 and supporting graphs show that this hypothesis is not supported as the mean gross profits generated were not zero as predicted.

Table 2: Significance of Reported Profit Results

Holding Period	**3 months**	**6 months**	**9 months**	**12 months**	**15 months**	**18 months**
t-Test Gross Profits	***2.04****	***3.03*****	***1.82****	***1.97****	1.04	-0.20
t-Test Net Profits	0.30	***1.66****	0.01	0.36	0.57	1.87

****** Denotes significance at 0.05 level*

******* Denotes significance at 0.01 level*

Table 2 shows the results of the *t*-tests for holding periods of three to eighteen months. While gross profits for four of the six holding periods tested produced results that were significant at statistically recognised levels, once transactions costs of $200 per spread trade were deducted the significance declined. Statistically significant net profits results were observed at the 0.05 level for the 6 month holding period. Therefore, the net profit of $8,039.47 for the 6 month holding period produced a t-statistic of 1.66 and was significant at the 0.05 level.

When considering Gross Profits, the results suggest that the EMH was not an accurate predictor of futures market behaviour as four of the six holding periods produced profits that were statistically different from the zero-expected return. On Aggregate, the EMH would appear to be supported once transactions costs were deducted with only one of the six holding periods considered producing statistically significant profits.

Funding costs from implementing the negative spread should be negligible due to the minimal deposit requirements of spread trades on the SFE. Appendix C provides information on the deposit requirements for implementing spreads across different expiry tiers. Deposit costs, on which the SFE Clearing House pays interest, for the six month holding period should be $200 per spread initially (being Tier 3 against Tier 2 Spread) and moving to $175 per spread for the final three months (being Tier 2 against Tier 2 Spread).

CONCLUSION

This paper has evaluated the profitability of trading calendar spreads on the SFE's 90 Day BAB futures contract during the period June 1990 to December 1998. For the gross profitability of the trading rules, the evidence suggests that the EMH Weak-Form appears not to have been an accurate depiction of trading activity during the period due to the persistence of the observed hump in the yield curve.

Before transaction costs, four from the six holding periods examined produced profits statistically significant at the 0.05 level and above. Once generous transaction costs were included, the six month holding period was the only one of the six holding periods examined producing profits statistically significant at the 0.05 level.

The implications of this research suggest that the presence of humped yield curve produces potentially profitable opportunities for futures spread traders. Should Australian interest rate markets see the hump disappear, to be replaced with a normal yield curve and an expectation of prolonged shape persistence, the trader may be able to profitably trade a 'positive spread'.

This means buying the near contract and selling the distant contract to profit from maturity differentials widening as opposed to the narrowing differentials discussed above.

As markets are often faced with a normal yield curve, the strategic spread trading possibilities suggest that ‘positive spreads’ may provide an additional trading tool to market participants. If shape persistence is observed, this type of research raises interesting avenues for future study across other interest rate markets and yield curve shapes.

While it may be tempting to suggest that the inherent structures/shapes of yield curves occasionally create profitable trading opportunities, it appears distinctly possible that the market has systematically impounded lower future interest rates expectations into market values. It will be left to other researchers to determine whether this has been the cause of the persistently humped yield curve so prevalent through the 1990’s.

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Appendix A: Quarterly Gross Profit Performance – All Contracts

Contracts Spread	3 months	6 months	9 months	12 months	15 months	18 months
M90/U90	$ 162.46					
U90/Z90	$ 696.58	$ 858.10				
Z90/H91	$ 815.43	$ 1,139.17	$ 139.96			
H91/M91	$ 957.44	$ 1,699.65	$ 301.08	$ 140.15		
M91/U91	$ 188.49	$ 1,121.30	$ 1,206.24	$ 419.28	$ 281.41	
U91/Z91	$ 117.60	$ 608.38	$ 929.84	$ 623.16	$ 22.52	-$ 23.46
Z91/H92	$ 1,756.68	$ 2,411.92	$ 605.00	$ 623.37	$ 110.73	-$ 143.37
H92/M92	-$ 166.89	$ 918.11	$ 917.55	$ 1,357.41	$ 656.64	$ 424.13
M92/U92	$ 1,264.69	$ 1,051.23	$ 252.49	$ 272.73	$ 338.94	-$ 428.45
U92/Z92	-$ 406.98	$ 208.73	$ 902.64	$ 511.67	$ 415.26	$ 180.15
Z92/H93	$ 333.77	$ 357.74	$ 466.75	$ 729.35	$ 53.59	-$ 112.98
H93/M93	$ 1,388.77	$ 1,577.30	$ 236.24	$ 673.21	$ 698.55	-$ 325.71
M93/U93	$ 384.22	$ 1,050.06	$ 900.80	$ 1,043.31	$ 1,240.12	$ 511.92
U93/Z93	-$ 385.25	$ 333.81	$ 950.52	$ 923.20	$ 1,301.91	$ 1,121.56
Z93/H94	-$ 192.70	$ 455.30	$ 1,100.60	$ 1,068.44	$ 899.42	$ 1,323.67
H94/M94	-$ 721.78	-$ 866.43	$ 549.55	$ 641.76	$ 705.31	$ 655.13
M94/U94	-$ 26.15	-$ 553.43	-$ 719.92	-$ 4.47	-$ 199.06	-$ 229.77
U94/Z94	-$ 593.01	-$ 1,480.98	-$ 1,174.01	-$ 1,294.29	-$ 677.08	-$ 870.85
Z94/H95	-$ 1,288.10	-$ 1,519.55	-$ 1,209.89	-$ 1,423.21	-$ 1,495.30	-$ 1,166.24
H95/M95	-$ 106.02	-$ 751.28	-$ 734.20	-$ 1,374.49	-$ 1,658.90	-$ 1,611.17
M95/U95	$ 1,391.54	$ 940.81	$ 99.06	$ 9.25	-$ 367.57	-$ 651.47
U95/Z95	$ 118.86	$ 683.38	$ 258.02	$ 1,014.44	$ 923.86	$ 642.31
Z95/H96	$ 451.98	$ 547.08	$ 163.60	-$ 24.49	$ 517.40	$ 638.10
H96/M96	-$ 404.14	-$ 166.32	$ 475.39	$ 189.15	$ 71.79	$ 518.65
M96/U96	-$ 142.56	-$ 260.89	-$ 189.92	$ 47.41	-$ 238.30	-$ 378.99
U96/Z96	$ 1,068.36	$ 428.07	-$ 568.40	-$ 758.86	-$ 521.76	-$ 783.75
Z96/H97	$ 358.75	$ 950.00	$ 70.60	$ 189.84	-$ 0.45	$ 236.43
H97/M97	-$ 358.96	-$ 1.65	$ 449.11	$ 189.48	$ 189.88	$ 118.51
M97/U97	$ 765.71	$ 670.92	-$ 384.70	-$ 290.73	-$ 503.06	-$ 407.85
U97/Z97	$ 360.39	$ 907.76	-$ 73.95	$ 234.98	-$ 51.96	-$ 122.26
Z97/H98	-$ 216.12	$ 238.96	-$ 3.44	$ 285.15	$ 139.72	-$ 98.60
H98/M98	$ 576.70	$ 601.44	-$ 242.79	$ 162.11	-$ 26.84	-$ 195.50
M98/U98	-$ 143.49	$ 216.11	$ 576.70	$ 645.04	$ 402.57	$ 142.06
U98/Z98	-$ 24.05	$ 264.67	$ 190.76	$ 767.66	$ 644.87	$ 332.48
Total	**$7,985.24**	**$14,645.46**	**$6,450.25**	**$7,602.99**	**$3,889.21**	**-$687.32**
Mean	**$234.86**	**$443.80**	**$201.57**	**$245.26**	**$129.64**	**-$23.70**
Number	**34**	**33**	**32**	**31**	**30**	**29**
Net Profit	**$1,185.24**	**$8,045.46**	**$50.25**	**$1,402.99**	**-$2,110.79**	**-$6,487.32**

Appendix B: Quarterly Net Profit Performance – All Contracts

Contracts Spread	3 months	6 months	9 months	12 months	15 months	18 months
M90/U90	-$37.54					
U90/Z90	$496.58	$658.10				
Z90/H91	$615.43	$939.17	-$60.04			
H91/M91	$757.44	$1,499.65	$101.08	-$59.85		
M91/U91	-$11.51	$921.30	$1,006.24	$219.28	$81.41	
U91/Z91	-$82.40	$408.38	$729.84	$423.16	-$177.48	-$223.46
Z91/H92	$1,556.68	$2,211.92	$405.00	$423.37	-$89.27	-$343.37
H92/M92	-$366.89	$718.11	$717.55	$1,157.41	$456.64	$224.13
M92/U92	$1,064.69	$851.23	$52.49	$72.73	$138.94	-$628.45
U92/Z92	-$606.98	$8.73	$702.64	$311.67	$215.26	-$19.85
Z92/H93	$133.77	$157.74	$266.75	$529.35	-$146.41	-$312.98
H93/M93	$1,188.77	$1,377.30	$36.24	$473.21	$498.55	-$525.71
M93/U93	$184.22	$850.06	$700.80	$843.31	$1,040.12	$311.92
U93/Z93	-$585.25	$133.81	$750.52	$723.20	$1,101.91	$921.56
Z93/H94	-$392.70	$255.30	$900.60	$868.44	$699.42	$1,123.67
H94/M94	-$921.78	-$1,066.43	$349.55	$441.76	$505.31	$455.13
M94/U94	-$226.15	-$753.43	-$919.92	-$204.47	-$399.06	-$429.77
U94/Z94	-$793.01	-$1,680.98	-$1,374.01	-$1,494.29	-$877.08	-$1,070.85
Z94/H95	-$1,488.10	-$1,719.55	-$1,409.89	-$1,623.21	-$1,695.30	-$1,366.24
H95/M95	-$306.02	-$951.28	-$934.20	-$1,574.49	-$1,858.90	-$1,811.17
M95/U95	$1,191.54	$740.81	-$100.94	-$190.75	-$567.57	-$851.47
U95/Z95	-$81.14	$483.38	$58.02	$814.44	$723.86	$442.31
Z95/H96	$251.98	$347.08	-$36.40	-$224.49	$317.40	$438.10
H96/M96	-$604.14	-$366.32	$275.39	-$10.85	-$128.21	$318.65
M96/U96	-$342.56	-$460.89	-$389.92	-$152.59	-$438.30	-$578.99
U96/Z96	$868.36	$228.07	-$768.40	-$958.86	-$721.76	-$983.75
Z96/H97	$158.75	$750.00	-$129.40	-$10.16	-$200.45	$36.43
H97/M97	-$558.96	-$201.65	$249.11	-$10.52	-$10.12	-$81.49
M97/U97	$565.71	$470.92	-$584.70	-$490.73	-$703.06	-$607.85
U97/Z97	$160.39	$707.76	-$273.95	$34.98	-$251.96	-$322.26
Z97/H98	-$416.12	$38.96	-$203.44	$85.15	-$60.28	-$298.60
H98/M98	$376.70	$401.44	-$442.79	-$37.89	-$226.84	-$395.50
M98/U98	-$343.49	$16.11	$376.70	$445.04	$202.57	-$57.94
U98/Z98	-$224.05	$64.67	-$9.24	$567.66	$444.87	$132.48
Total	**$1,182.22**	**$8,039.47**	**$41.28**	**$1,391.01**	**-$2,125.79**	**-$6,505.32**
Mean	**$34.77**	**$243.62**	**$1.29**	**$44.87**	**-$70.86**	**-$224.32**
Number	**34**	**33**	**32**	**31**	**30**	**29**

Appendix B: Sydney Futures Exchange Spread Deposit Requirements

90 Day Bank Accepted Bill	*Months in Tier*	*Tier 1*	*Tier 2*	*Tier 3*	*Tier 4*	*Tier 5*
Tier 1	1	-	-	-	-	-
Tier 2	2 to 3	$300	$175	-	-	-
Tier 3	4 to 8	$425	$200	$150	-	-
Tier 4	9 to 12	$450	$350	$225	$175	-
Tier 5	13 to 20	$675	$650	$650	$650	$500

Source: http://www.sfe.com.au/ (29 March 2000)